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Single-Atom Catalysts of Platinum for Electrochemical Reactions: Activity, Selectivity, and Support Effect

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Single-atom catalysts are atomically dispersed metal atoms anchored on the support surface. Single-atom catalysts exhibit intriguing catalytic properties due to its surface structure that active atoms are well separated with each other, and each individual atoms interact with support atoms. Herein, we show different types of Pt single-atom catalysts using different support materials: gold nanoparticles, titanium nitride, titanium carbide, and antimony doped tin oxide. Pt single-atom catalysts exhibited several interesting features in electrochemical reactions. Near hundred percent metal utilization of Pt led to high mass activities in electrochemical reactions. Absence of ensemble site, atomically dispersed active sites, was responsible for controlling the reaction pathways. Support effect was much more pronounced in single-atom catalysts due to stronger interaction between single-atom and support atoms. Still in their early development, single-atom electrocatalysts will open new opportunities in various electrochemical reactions for future energy applications.